Inventors: Hsieh Kun Lee
WanLin Xia
Tao Li
Lei Li

# SPECIFICATION

## HEAT SINK WITH COMBINED FINS

## BACKGROUND OF THE INVENTION

1. Field of the invention

[0001] The present invention relates to heat sinks, and particularly to a heat sink having high density fins in which the fins are firmly combined together.

2. Prior art

[0002] Advances in microelectronics technology have resulted in electronic devices which process signals and data at unprecedented high speeds. During operation of many contemporary electronic devices such as central processing units (CPUs), large amounts of heat are produced. The heat must be efficiently removed, to prevent the system from becoming unstable or being damaged. Heat sinks are frequently used to dissipate heat from these electronic devices.

[0003] Contemporary CPUs are also being made smaller than previously. Thus a modern CPU can generate a huge amount of heat in a relatively small volume. A typical heat sink is integrally made by extruding aluminum. The heat sink has a base, and a plurality of spaced, parallel fins extending upwardly from the base. However, the width-to-height ratio of the heat sink is limited by the extrusion process. Thus, the effective heat-dissipating area of the heat sink is restricted.

[0004] In order to overcome the limitations of extrusion, a folded-fin structure for a heat sink has been devised. The folded-fin structure is integrally concertinaed, and is made by bending a single metal sheet. This kind of heat sink has no limitations on the width-to-height ratio of the fins. For example, Taiwan

Pat. No. 390459 discloses a heat sink with folded fins. However, a total contact area between the fins and a heat conductive base of the heat sink is only half of an area of the base. Because the contact area is limited, transfer of heat from the base to the fins is correspondingly limited.

[0005] In order to overcome the above-described contact area problem, another kind of heat sink has been devised. The heat sink includes a plurality of stacked fins. Each fin is separately formed. The fins are then stacked together, and attached onto a base. This kind of heat sink provides a much larger contact area between the fins and a heat conductive base. For example, China Pat. No. 00209935.7 discloses combined heat sink fins. Each fin forms two flanges at upper and lower ends thereof. A plurality of tabs and a plurality of cutouts are formed at each flange of each fin. An indent portion is formed in each tab. The tabs of each fin are extended into corresponding cutouts of an adjacent fin. The indent portions prevent the tabs from escaping from the cutouts. All the fins are thereby combined together.

[0006] However, the combined fins are relatively loose, because the fins are combined together only by way of the tabs extending into cutouts. The combined fins are easily deformed, and difficult to keep intact during transportation or assembly. In addition, combining points of the fins are located at lower and upper ends of the fins, which creates an uneven contacting surface between the combined fins and a heat-conductive base. The uneven contacting surface comprises a plurality of recessed portions, and lowers the heat transfer efficiency of the heat sink.

[0007] An improved heat sink with combined fins which overcomes the above-mentioned problems is desired.

## BRIEF SUMMARY OF THE INVENTION

[0008] Accordingly, an object of the present invention is to provide a heat sink having high density fins which can be configured to have any width-to-height ratio.

[0009] Another object of the present invention is to provide a heat sink having fins which are firmly combined together.

[0010] A further object of the present invention is to provide a heat sink having high density fins and locking structures for assembling the fins together and increasing a strength of the heat sink.

[0011] To achieve the above-mentioned objects, a heat sink of a preferred embodiment of the present invention comprises a heat-conductive base, and a plurality of combined fins uprightly attached onto the base. Each fin comprises a main body, and a flange extending perpendicularly from the main body. A pair of locking plates is bent downwardly from an upper edge of the main body. A pair of blocking tabs is stamped from the main body, corresponding to a middle portion of each locking plate. A receiving space is defined between said pair of blocking tabs and the main body. The locking plates and the blocking tabs are respectively located at opposite main faces of the main body. The locking plates of each fin are inserted in the receiving spaces of an adjacent fin, whereby the fins are firmly combined together.

[0012] Other objects, advantages and novel features of the present invention will be drawn from the following detailed description of the preferred embodiment of the present invention with the attached drawings, in which:

## BRIEF DESCRIPTION OF THE DRAWINGS

[0013] Fig. 1 is an isometric view of a fin of a heat sink in accordance with the preferred embodiment of the present invention;

[0014] Fig. 2 is similar to Fig. 1, but viewed from another aspect;

[0015] Fig. 3 is an isometric view of a plurality of the fins of Fig. 1 assembled

together;

[0016] Fig. 4 is an enlarged view of an encircled portion IV of Fig. 3; and

[0017] Fig. 5 is an isometric view of the heat sink in accordance with the preferred embodiment of the present invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

[0018] Referring to Figs. 1-5, a heat sink 1 in accordance with the preferred embodiment of the present invention is used to dissipate heat from a heat-generating element such as a CPU (not shown). The heat sink 1 comprises a heat-conductive base 20, and a plurality of combined fins 10 uprightly attached onto the base 20. Each fin 10 is formed by stamping a flat metal sheet.

[0019] Each fin 10 comprises a main body 12, and a flange 14 extending perpendicularly from a bottom end of the main body 12. Two locking plates 16 extend outwardly and then downwardly from opposite sides of a top edge of the main body 12 respectively. A folded portion 17 is formed inwardly from a distal end of each locking plate 16. The locking plates 16 are located at a same side of a first main face of the main body 12. A pair of L-shaped blocking tabs 18 is stamped from the main body 12 with an opening (not labeled) left in the main body 12, corresponding to middle portions of the locking plates 16 respectively. The blocking tabs 18 are located at a same side of an opposite second main face of the main body 12. The blocking tabs 18 in each pair of blocking tabs 18 extend toward each other and slightly toward the second main face of the main body 12. A receiving space is defined between each pair of blocking tabs 18 and the main body 12.

[0020] In assembly, the locking plates 16 of each fin 10 are inserted into the receiving spaces of an adjacent fin 10. The inwardly extending blocking tabs 18 of said adjacent fin 10 closely abut the corresponding locking plates 16. The

folded portions 17 of the locking plates 16 of each fin 10 abut lower edges of the blocking tabs 18 of the adjacent fin, for preventing the locking plates 16 from escaping from the blocking tabs 18. The fins 10 are thereby firmly combined together. The flanges 14 of the fins 10 cooperatively form a surface for contacting the base 20. Then, the combined fins 10 are attached to the base 20 by means of welding or sintering.

[0021] It is understood that the invention may be embodied in other forms without departing from the spirit thereof. Thus, the present example and embodiment are to be considered in all respects as illustrative and not restrictive, and the invention is not to be limited to the details given herein.